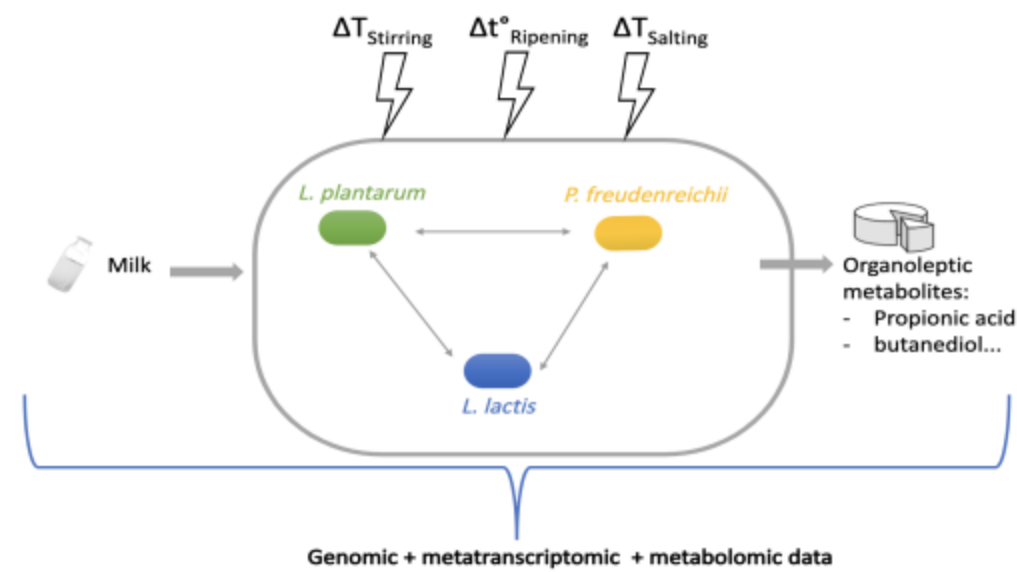


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Context

- How do industrial processes impact cheese's aroma and taste ?
- **Fermentation** process enables bacteria to produce **organoleptic compounds**
- Bacteria uptake compounds in growth media and release final compounds in the shared environment
- **Variant itineraries** are tested and their effect is measured through multi-omics experiments [1]



Experimental pipeline

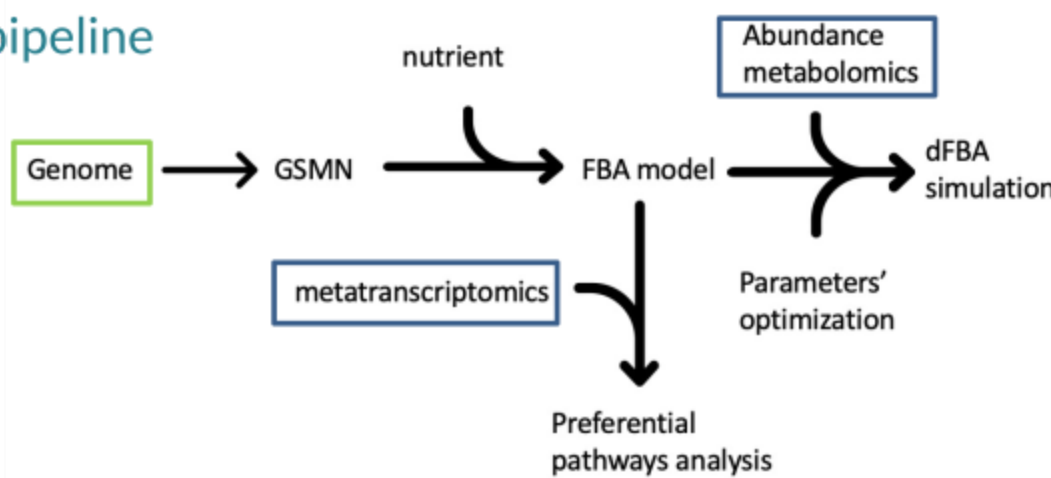


Figure 1: Overall pipeline used to produce results (is being automated). Green square shows the minimal requirement to achieve FBA model and dFBA simulation. Blue squares show available data which improve the accuracy of the result.

Genome scale metabolic network (GSMN) of the cheese community

Bacteria	Genes	Reactions	Associated reactions	% reactions associated at least one gene
<i>L. Plantarum</i>	1433	1517	1016	67
<i>L. Lactis</i>	1272	1335	940	70
<i>P. Freudenreichii</i>	1473	1789	1177	66

Table 1 : Representation of global characteristics of each GSMN [2,4] : number of genes and reactions identified, number of reactions associated to a gene and percentage of reactions linked at least one genes.

Application and results

Small cheese bacterial community : *L. lactis* (Ll), *L. plantarum* (Lp) and *P. freudenreichii* (Pf)

Cooperation Ll/Pf and Lp/Pf --> lactic acid

Cooperation Ll/Pf --> acetaldehyde

Competition Ll/Lp --> carbon source (lactose)

Preferential pathway identified in accordance with literature [5]

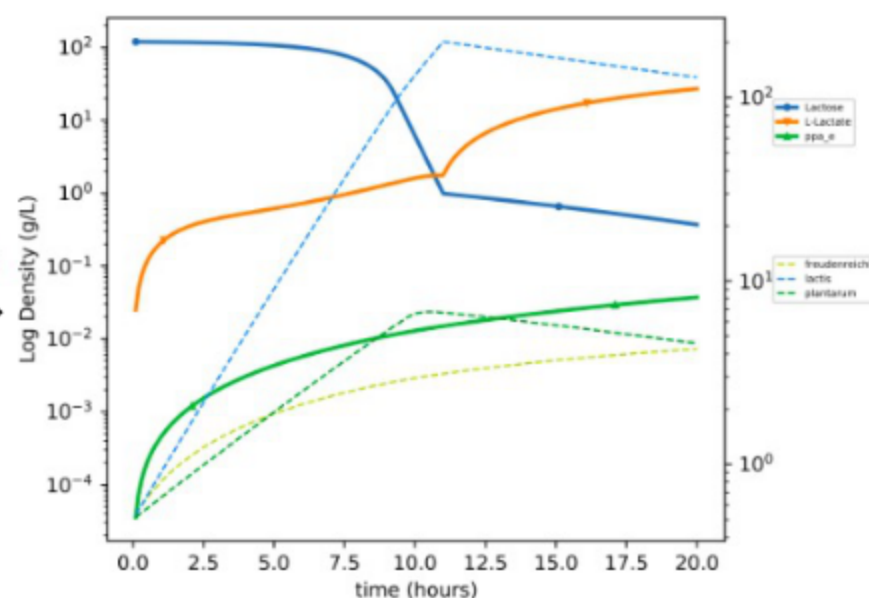


Figure 2 : Preliminary results of dFBA [2,3] on the whole community:
 - Production of organoleptic compound for Pf (propionic acid) from lactate
 - Cooperation between lactic species and Pf

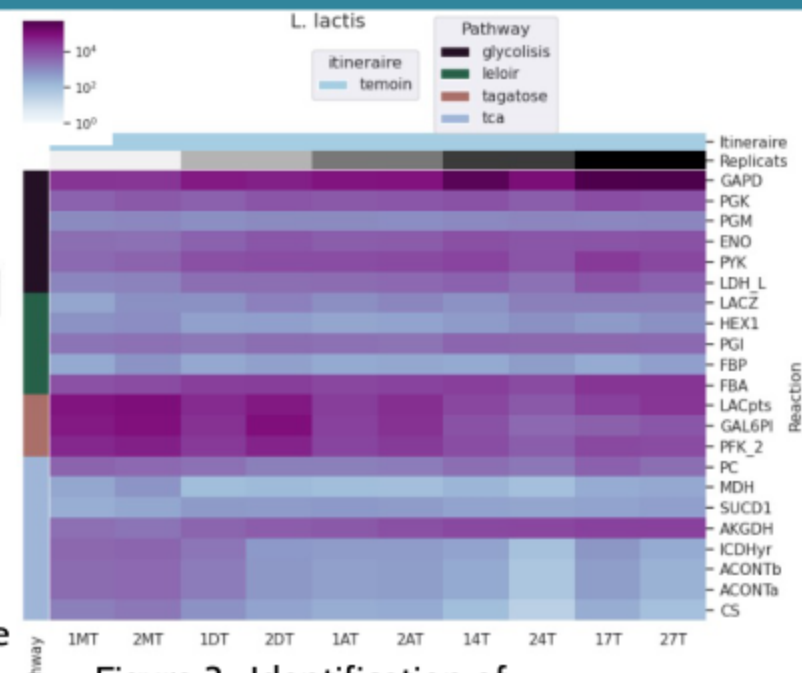


Figure 3 : Identification of preferential pathway for Ll --> uptake lactose first with tagatose then glycolysis pathway

Discussion

- Identify **preferential pathways** thanks to metatranscriptomic data in the production of organoleptic compounds
- Decipher **Interactions bacterium-bacterium** within the bacterial community
- **Salting variant** has no effect in the production of organoleptic compounds

References

- [1] Falentin et al, Agricultural and Food Chemistry, accepted
- [2] A. Varma et al, Appl. Environ. Microbiol., 1994
- [3] Mahadevan et al, biophys, 2002
- [4] Belcour et al, eLife, 2020
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